AbstractID: 3400 Title: Modeling Skin Collimation Using Electron Pencil-Beam Redefinition Algorithm

Purpose: To modify the pencil-beam redefinition algorithm (PBRA) to model skin collimation and to verify that the modified PBRA can accurately calculate dose in the presence of skin collimation for both electron fixed and arced beams.

Method and Materials: The PBRA continuously redefines pencil beams at equally spaced depth. For pencil beam pixels fully (partially) shielded by skin collimation further propagation of all (a portion) of the pencil beam is terminated. The accuracy of the modified PBRA for skin collimation (10-mm thick lead) was verified at 10 and 15 MeV. Fixed beam measurements were performed using a scanning diode detector in water: air gap is 32 cm, field size is 20x6 cm^2, and skin collimation is at +5.0 cm. Arced beam measurements were performed in a cylindrical, plastic phantom (ρ=13.5 cm) using film dosimetry: arc angle is ± 45º, skin collimation edge is at ± 30º, and field size is 5x20 cm^2.

Results: *Fixed beam:* For 10 MeV, the calculations and measurements agreed within 2% in the low dose-gradient region (Dose>90% and Dose <10%) and within 2 mm distance to agreement (DTA) in the high dose-gradient region (10%<Dose<90%). For 15 MeV, calculations and measurements agreed within 5% in the low dose-gradient region and within 2 mm DTA in the high dose-gradient region. Differences from 3-5%, limited to a small volume distal to and just inside the skin collimation edge, were due to the modified PBRA not modeling scatter from the skin collimation. *Arced beam:* For both energies, the calculations and measurements agreed within 2% in the low dose-gradient region and within 1 mm DTA in the high dose-gradient region.

Conclusion: Results showed that the PBRA is easily modified to include skin collimation and that it can calculate dose in a water or plastic phantom sufficiently accurately for clinical use.